

*EFFECTS OF GENERAL-CASE TRAINING, INSTRUCTIONS,  
REHEARSAL, AND FEEDBACK ON THE REDUCTION OF  
SIGHT-READING ERRORS BY COMPETENT MUSICIANS*

NANCY ELLEN DIB AND PETER STURMEY

CITY UNIVERSITY OF NEW YORK GRADUATE CENTER  
AND QUEENS COLLEGE

We used general-case training, instructions, rehearsal, and feedback to teach 3 advanced flute students to improve their sight-reading skills. Training resulted in systematic decreases in note errors, rhythm errors, repetitions, and hesitations for each participant. The procedures and outcomes were socially validated through subjective evaluation by the participants and music teachers not involved with the study.

*Key words:* flute playing, general-case training, musical skills, sight reading, skills training

Behavior-analytic research has been conducted on a variety of music-related skills, including posture (Dib & Sturmey, 2007), hand position (Salzberg & Salzberg, 1981), reading notation (Eisenstein, 1976), and performance (Wolpov, 1976). However, no research to date has addressed sight reading of music. Sight reading is an important skill for all musicians because it enables them to respond to novel stimuli (i.e., notes on sheet music) quickly, thus reducing rehearsal time. Sight reading is a repertoire that involves emitting novel combinations of responses (response generalization) to novel sequences of stimuli (stimulus generalization) when playing music the musician has not previously encountered.

Stokes and Baer (1977) asserted that the most prominent and extensive method of training generalization was to train sufficient exemplars of relevant stimuli or responses. Two approaches for accomplishing this goal have been previously evaluated: multiple-exemplar training, which incorporates many training stimuli, and general-case training, which uses multiple training stimuli that are carefully chosen to sample the span of the stimulus and response variation that defines the “instructional uni-

verse” of the target skill (Horner & McDonald, 1982; Sprague & Horner, 1984). Musical sight reading appears to be particularly well suited to general-case training, with the four properties that define its instructional universe being (a) notes, (b) rhythms, (c) articulations, and (d) dynamics. Thus, the purpose of the present study was to evaluate the effects of general-case training, instructions, feedback, and rehearsal to reduce sight-reading errors by advanced flute players who had previously mastered articulations (tonguing of notes) and dynamics (volume of notes). Training focused on the performance dimensions of playing correct notes (through the use of various musical key signatures) and rhythms (through the use of different time signatures).

## METHOD

### *Participants and Setting*

Participants were three typically developing adolescents (14 to 17 years old), two girls and one boy, who attended a private music school. They were identified as advanced music students by their previous participation in the New York State School Music Association Festival at Levels 5 or 6 (the two highest levels). All sessions took place in their regular classroom (2.43 m by 2.43 m) which contained two chairs, a music stand, a keyboard, and a video

Address correspondence to Nancy Dib, 14 Stanford Court, Rhinebeck, New York 12572 (e-mail: DibNancy@aol.com).

doi: 10.1901/jaba.2011.44-599

camera positioned on a tripod in the left rear corner of the room. Only the participant and the experimenter (the first author) were in the room during sessions. The experimenter was the participants' regular flute teacher.

### *Stimuli*

The first author used a matrix to create 120 sight-reading pieces that sampled all of the possible key and time-signature combinations. Fifteen pieces were selected for training, and the remaining 105 pieces were used during baseline and posttraining conditions and were never experienced more than once. The 15 training pieces served as the general-case training component of the study, because they sampled the relevant dimensions that define the instructional universe of sight reading. To control for difficulty, all pieces contained the same number of each type of musical note for each time signature. Musical pieces were presented to participants in a random order.

### *Response Measurement and Reliability*

The target behaviors were four types of musical errors: (a) *note errors*, defined as playing a pitch that was different from what was written in the musical piece; (b) *rhythm errors*, defined as playing a note or rest longer or shorter than its written value; (c) *repetitions*, defined as replaying a part or all of the measure instead of moving on to the next measure; and (d) *hesitations*, defined as any pause that interrupted playing through the measure and did not occur on a rest.

The experimenter videotaped each participant during half of his or her usual 30-min lesson once per week for 7 months. Lessons were expanded to 60 min for the last 2 months to increase measurement opportunities due to the impending end of the school year. The presentation of each piece constituted a session, and approximately four sessions were conducted during each 30-min lesson (approximately eight were conducted during 60-min lessons).

The experimenter and an independent observer (another musician) viewed and scored from videotape each musical error and marked them on a copy of the sheet music. Data on note and rhythm errors were converted to a percentage of notes containing each error, calculated by dividing the number of errors in each piece by the number of notes in the piece and converting the ratio to a percentage. Repetitions and hesitations were expressed as frequency per session. Observers recorded notes that participants played incorrectly during repetitions as a note error only once, but they counted multiple repetitions each time they occurred.

Interobserver agreement was calculated by comparing the written records of the experimenter and the independent observer on an error-by-error basis. An agreement was defined as both observers recording the same error at a specific point in the musical piece. Occurrence agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and converting the ratio to a percentage. Agreement was assessed for 75% of randomly selected sessions and averaged 97% (range, 93% to 99%), 99% (range, 96% to 99%), and 99% (range, 93% to 99%) for Participants 1, 2, and 3 respectively.

### *Procedure*

*Design.* A concurrent multiple baseline design across participants was used to evaluate the effects of training on musical errors.

*Baseline.* The experimenter required participants to play a random selection of the 105 musical pieces (one piece per session) and provided neutral feedback within 10 s of completion of each piece (e.g., "Good try; let's try another one."). The participants played each piece only once, and none of the baseline pieces were repeated at any point during the study.

*Training.* The experimenter required participants to play the 15 training pieces in random order during the implementation of a skills-training package that included verbal instruc-

tion, feedback, and rehearsal. First, the experimenter told the participants what correct sight reading was and what to look for when preparing to play a new piece of music. The experimenter then asked the participant to sight read the music. When the participant stopped playing, the experimenter provided feedback within 10 s. She first told the participant what he or she did well with respect to each of the four dependent variables. The experimenter then immediately showed the participant a copy of the music with marked errors and pointed to the markings while describing each error. Each feedback delivery ended with a positive comment. The experimenter then saved this piece to be presented at a later time during training, presented the next one of the 15 pieces, and repeated the training procedure. If the participant played a piece correctly, that piece was not presented again during the study. Training was discontinued when a participant played all 15 pieces correctly.

*Posttraining.* The procedures for the post-training condition were identical to baseline.

#### *Treatment Integrity*

An independent observer viewed session videotapes and used checklists to score the experimenter's implementation of the skills-training package (e.g., delivered feedback within 10 s, showed participant marked errors) for four randomly selected sessions per phase. The observer calculated treatment integrity by dividing the total number of correct items by the total number of items on the checklist and converting the ratio to a percentage. Treatment integrity was 100% for each participant.

#### *Social Validity*

The experimenter assessed the social validity of the study's goal, procedures, and outcome by presenting a paper-and-pencil survey to the participants at the end of the study. Participants responded positively to all questions about (a) the importance of reducing the four types of musical errors targeted in the study, (b) the

effectiveness of the training method, and (c) the degree of improvement they experienced. In addition, 10 music teachers who did not have regular contact with the participants and who were blind to the experimental conditions observed and rated videotapes of each participant's sight reading during three baseline and three posttraining sessions. The teachers' mean ratings of sight-reading accuracy increased from 39% during baseline to 84% after training (social validity measures and results are available from the first author).

## RESULTS AND DISCUSSION

Figure 1 shows that the percentage of note errors decreased after training (from a mean of 11%, 24%, and 5% during baseline to a mean of 1%, 6%, and 1% after training for Participants 1, 2, and 3, respectively). Similarly, the average percentage of rhythm errors decreased from 42%, 59%, and 39% during baseline to 3%, 7%, and 4% after training for Participants 1, 2, and 3, respectively. Figure 2 shows a systematic decrease in the frequency of repetitions from an average of 18, 2, and 6 during baseline to an average of 1, 0, and 2 after training for Participants 1, 2, and 3, respectively. The average frequency of hesitations decreased from 2, 2, and 3 during baseline to 1, 0, and 0 after training for Participants 1, 2, and 3, respectively.

These results add to research that has demonstrated the effectiveness of behavior-analytic procedures for teaching musical behavior (e.g., Dib & Sturmey, 2007; Eisenstein, 1976; Salzberg & Salzberg, 1981). Furthermore, the study adds to the general-case training literature by demonstrating its suitability for improving the musical repertoires of already-competent musicians.

The present findings should be evaluated in light of at least two limitations. First, although the combination of general-case training with other components (e.g., instructions) was effective, their independent effects on musical

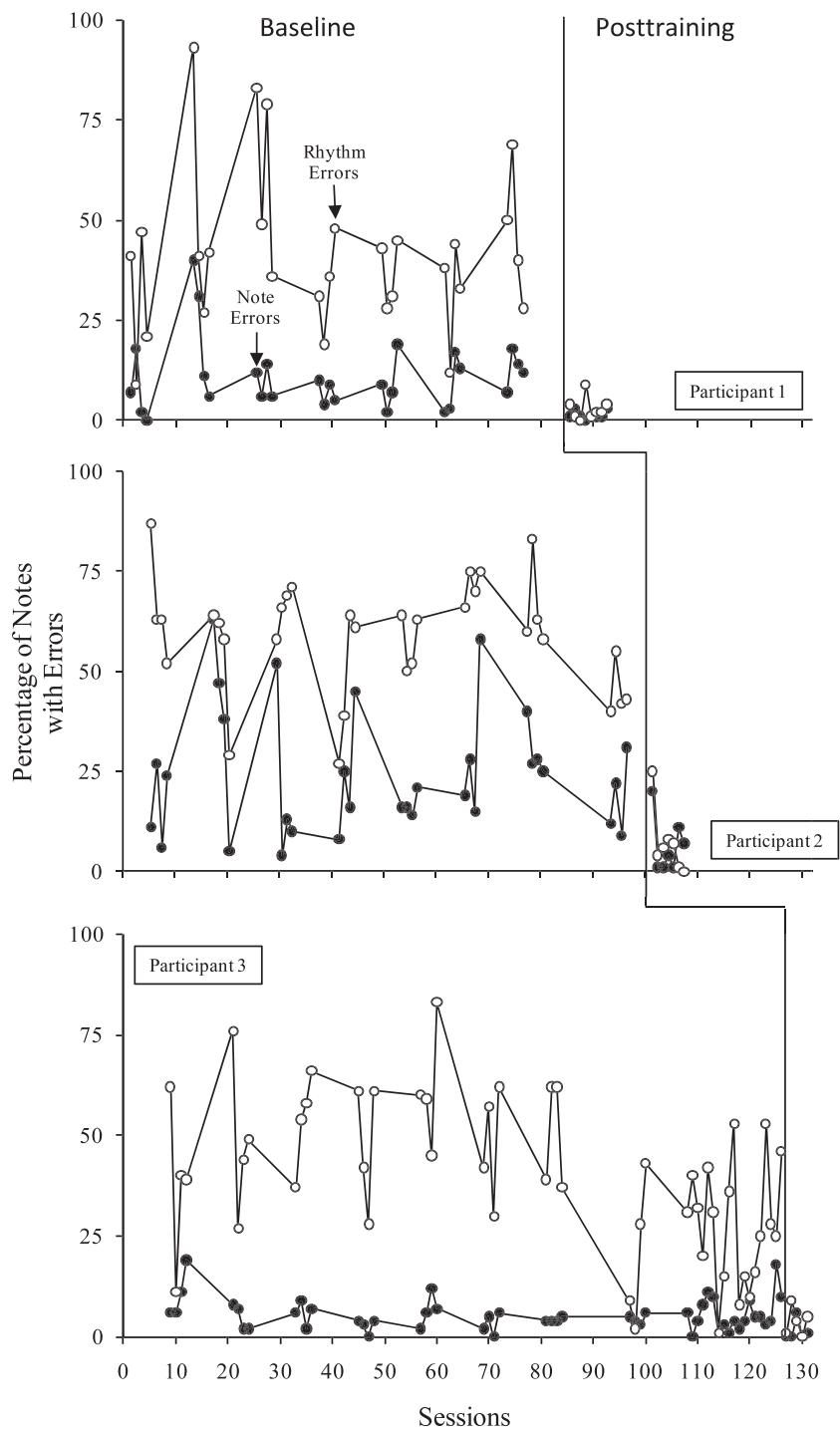


Figure 1. Percentage of notes with note errors (filled circles) and rhythm errors (open circles) during sight-reading sessions across baseline and posttraining sessions.

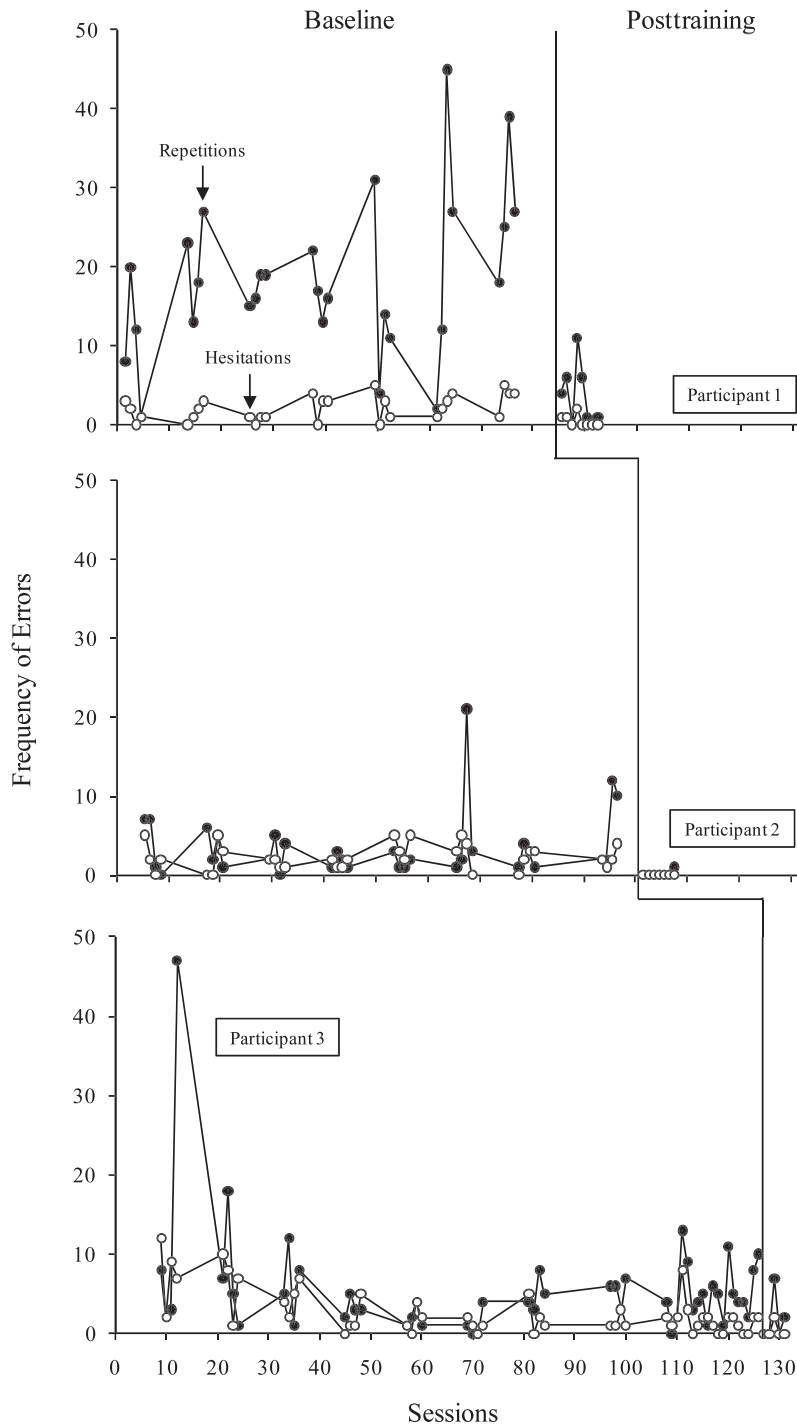


Figure 2. Frequency of repetitions (filled circles) and hesitations (open circles) during sight-reading sessions across baseline and posttraining sessions.

behavior cannot be discerned because they were combined in a training package. Future research could investigate the components of the package individually to determine their independent effects. Second, the focus of the study was limited to sight reading rather than a broader range of musical behavior. Although there is little reason to believe that similar behavioral training procedures would not be effective with other musical response topographies, additional investigations of this sort are warranted.

## REFERENCES

- Dib, N. E., & Sturme, P. (2007). The effects of verbal instruction, modeling, rehearsal, and feedback on correct posture during flute playing. *Behavior Modification*, 31, 382–388.
- Eisenstein, S. R. (1976). A successive approximation procedure for learning music symbol names. *Journal of Music Therapy*, 13, 173–179.
- Horner, R. H., & McDonald, R. S. (1982). Comparison of single instance and general case instruction in teaching a generalized vocational skill. *Journal of the Association for the Severely Handicapped*, 8, 7–20.
- Salzberg, R. S., & Salzberg, C. L. (1981). Praise and corrective feedback in the remediation of incorrect left-hand positions of elementary string players. *Journal of Research in Music Education*, 29, 125–133.
- Sprague, J. R., & Horner, R. H. (1984). The effects of single instance, multiple instance, and general case training on generalized vending machine use by moderately and severely handicapped students. *Journal of Applied Behavior Analysis*, 17, 273–278.
- Stokes, T. F., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis*, 10, 349–367.
- Wolpow, R. I. (1976). The independent effects of contingent social and academic approval upon the musical on-task and performance behaviors of profoundly retarded adults. *Journal of Music Therapy*, 13, 29–38.

Received March 1, 2010

Final acceptance January 10, 2011

Action Editor, James Carr